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Research Summary

GROWTH of JUVENILE ENGELMANN SPRUCE ON SKIDROADS (ESSFc NELSON FOREST REGION)

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Soil degradation and subsequent losses in forest productivity, are major concerns in British Columbia. Forest harvesting is the main cause of soil degradation, and guidelines have been developed to limit the amount of severe soil disturbance. In the Nelson Forest Region, skid roads are the most common source of this type of soil disturbance. In this study, we sampled trees on older skidroads to provide estimates of these growth losses.

Engelmann spruce growth on skidroads was sampled on two sites in the Moist Engelmann Spruce Subalpine Fir (ESSFc) biogeoclimatic subzone of Southeastern British Columbia in 1988. The two sites represented the extremes of elevation in this subzone: 1555 m (Eleven Mile), and 1890 m (La France). Both sites were on a northeastern aspect with a typical, rooting zone soil of gravelly sandy loam textured acidic morainal and colluvial material, derived from local bedrock typical of the respective mountain ranges (sedimentary at La France and granitic at Eleven Mile). The average moisture regime was submesic at La France Creek, and mesic - submesic at Eleven Mile Creek. Localized seepage was present in both areas.

Trees were sampled from specific **disturbance classes** that were shown by previous research (Smith and Wass 1979) to have different impacts on growth: skidroad inner track (IT), outer track (OT), sidecast (SC) and undisturbed (UU). At each site, a total of 192 naturally regenerated trees were sampled, 48 trees from each disturbance class. Post-harvest silvicultural treatment was limited to spot burning at La France Creek. No treatment occurred at Eleven Mile Creek.

At age 12 the trees were generally taller on the low elevation site, as expected (Figure 1). At both sites, the **percentage differences in total** total height and three year increment between the disturbance classes were similar (Figure 1). Relative total height and three year increment on a rank order basis was:

$$UU \cong SC > OT >> IT$$

Three year increment was significantly lower on the inner and outer track at both sites (Figure 1), suggesting that currently observed reductions in growth will become larger in the near future, and possibly long term.

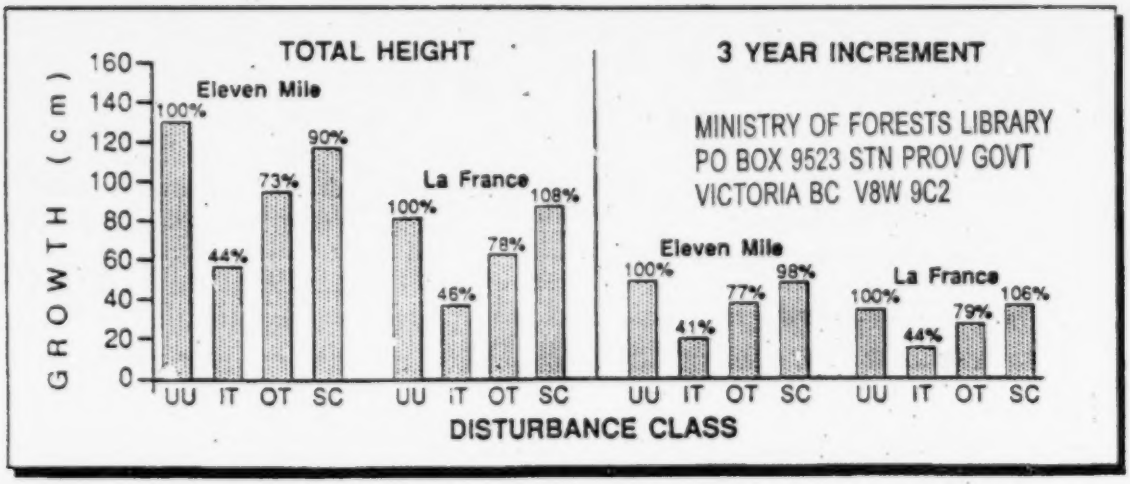

Figure 1 Total height and 3 year increment at 12 years age. Percentages above bars are relative to the undisturbed. (UU=Undisturbed; IT=Inner Track; OT=Outer Track; SC=Sidecast).

The main factors causing growth reduction were inferred to be soil compaction and nutrient depletion due to soil displacement during skidroad construction. The largest reductions occurred on the inner track where the combined effect of compaction and displacement was greatest. The least severe type of disturbance was in the sidecast, where three year increment was almost identical to undisturbed trees at Eleven Mile, and slightly greater than undisturbed trees at La France. The higher sidecast three year increment at La France Creek was attributed to a combination of 3 factors: 1) increased soil temperature, 2) reduction in levels of competing vegetation and 3) lack of compaction. Soil temperature was inferred to be a major growth limiting factor at this high elevation, north facing site.

Comparison with untreated, undisturbed trees may underestimate potential growth reductions due to soil degradation. Site preparation resulting in a reduction of vegetation competition and surface soil mixing may have improved undisturbed tree growth at both sites due to an increase in soil warming and incorporation of organic matter. Disruption of natural drainage due to skidroad construction may also have decreased available moisture for undisturbed trees.

In a previous study of Engelmann spruce on skidroads in Southeastern B.C., Smith and Wass (1979) found both enhancement and reduction of growth. On non-calcareous soils, growth of sidecast trees was consistently increased. Inner track growth either decreased, or was not significantly different, and outer track growth increased, decreased or did not change, depending on the site. In general, the results of the current study show greater height growth reductions on the skidroad surface than previously measured. A comprehensive review of soil disturbance growth effects can be found in Utzig and Walmsley (1988).

CONCLUSIONS

Conclusions of this study were:

1. Soil compaction and soil displacement significantly reduced growth at both sites. The greatest reductions occurred where the combined effect of both factors was greatest.
2. Twelve year old **outer track** trees are 22 - 27% shorter than undisturbed trees. Growth will be reduced by an even larger percentage in the near future, and possibly the long term.
3. Trees on the **inner track** are 56 - 59% shorter than undisturbed trees at age 12. It is unlikely that inner track trees will be merchantable at the rotation age of these cutblocks. The larger reduction in inner track growth was due to the combined effects of soil compaction and gouging greater than 25 cm deep.
4. Sidecast growth was dependent on the site. In the cold environment at La France Creek, tree growth at 12 years age was slightly improved in the sidecast. At Eleven Mile Creek, growth was slightly reduced. The differences were not statistically significant in either case. It is inferred that sidecast and undisturbed tree growth will be similar in the near future.
5. Trees at least 15 - 20 years age must be sampled to obtain more conclusive forecasts of rotation age growth effects. For the trees measured in this study, approximately 40% of total height growth occurred in the three years prior to sampling.

LITERATURE CITED

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